Fisheries and Oceans Canada | Pêches et Océans Canada
Ecosystems and Oceans Science | Sciences des écosystèmes et des océans

Canadian Science Advisory Secretariat (CSAS)

Proceedings Series 2018/015

Québec Region

Proceedings of the Regional Peer Review of the Assessment of the West Coast of Newfoundland (NAFO 4R division) herring stocks in 2017

May 2, 2018
Mont-Joli, Quebec

Chairperson: Mathieu Desgagnés
Editor: Virginie Christopherson

Maurice Lamontagne Institute
Fisheries and Oceans Canada
850 Route de la Mer, P.O. Box 1000
Mont-Joli, Quebec G5H 3Z4

August 2018

Canada

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

Published by:

Fisheries and Oceans Canada
Canadian Science Advisory Secretariat
200 Kent Street
Ottawa ON K1A 0E6

http://www.dfo-mpo.gc.ca/csas-sccs/
csas-sccs@dfo-mpo.gc.ca

© Her Majesty the Queen in Right of Canada, 2018
ISSN 1701-1280

Correct citation for this publication:

DFO. 2018. Proceedings of the Regional Peer Review of the Assessment of the West Coast of Newfoundland (NAFO 4R division) herring stocks in 2017; May 2, 2018. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2018/015.

Aussi disponible en français :

MPO. 2018. Compte rendu de l'examen régional par des pairs sur l'évaluation des stocks de hareng de la côte ouest de Terre-Neuve (division 4R de l'OPANO) en 2017; le 2 mai 2018. Secr. can. de consult. sci. du MPO, Compte rendu 2018/015.

TABLE OF CONTENTS

SUMMARY IV
INTRODUCTION 1
CONTEXT 1
RESOURCE ASSESSMENT 1
2016 AND 2017 COMMERCIAL LANDINGS 1
BIOLOGICAL DATA 1
MULTIDISCIPLINARY SURVEYS 2
2017 ACOUSTIC SURVEY 2
ENVIRONMENTAL IMPACT ON STOCK INDICATORS 3
ANALYTICAL MODEL 3
CONCLUSIONS 4
IDENTIFICATION OF FUTURE RESEARCH WORK 4
INTERIM YEARS 4
SCIENTIFIC ADVICE HIGHLIGHTS 4
APPENDIX 1- TERMS OF REFERENCE 5
APPENDIX 2- LIST OF PARTICIPANTS 7

SUMMARY

This document contains the proceeding from the meeting held within the regional assessment process of the West Coast of Newfoundland (NAFO 4R division) herring stocks. This review process was held on May 2nd, 2018 at the Maurice Lamontagne Institute in Mont-Joli. This meeting gathered about thirty participants from sciences, management and herring fishery industry. This proceeding contains the essential parts of the presentations and discussions held and relates the recommendations and conclusions that were presented during the review.

INTRODUCTION

The Quebec Region of Fisheries and Oceans Canada (DFO) is responsible for assessing several stocks of fish and invertebrate species harvested in the Estuary and Gulf of St. Lawrence. Most of these stocks are periodically assessed as part of a regional advisory process conducted at the Maurice Lamontagne Institute in Mont-Joli. This document consists of the proceedings of the meeting held on May 2nd, 2018, on the assessment of the West coast of Newfoundland (4R) Herring stocks.

The objective of the review was to determine whether there are any changes in the resource's status and whether management plans need to be adjusted based on the chosen conservation approach, the ultimate goal being to formulate a Science Advisory Report on the management of Herrgin stocks in the West coast of Newfoundland (4R) for the 2018 and 2019 fishing seasons. The Resource Management and Aboriginal Affairs Branch also requested scientific advice to determine if the current minimum size limit of 26.5 cm at the fork corresponds to the 50% maturity size for herring on the west coast of Newfoundland.

These proceedings report on the main points of the presentations and deliberations that arise from the regional stock assessment committee's activities. The regional review is a process open to all participants who are able to provide a critical outlook on the status of the assessed resources. Accordingly, participants from outside DFO are invited to take part in the committee's activities within the defined terms of reference for this review (Appendices 1 and 2). The proceedings also list the recommendations made by meeting participants.

CONTEXT

Meeting chair Mathieu Desgagnés welcomes the participants. He goes over the peer review objectives and agenda. After the participants introduce themselves, stock assessment biologist Hans-Frédéric Ellefsen begins the meeting by highlighting the contribution of his collaborators. He presents the agenda and the framework for the review. He reviews the highlights of the last Science Advisory Report and a few aspects of herring biology and the 4R stock, which includes two groups of spawners: spring (April-May) and fall (August-September) spawners. Mr. Ellefsen also briefly describes the fishery.

RESOURCE ASSESSMENT

2016 AND 2017 COMMERCIAL LANDINGS

The biologist presents landing statistics by unit area, fishing gear, landing date and spatial area of catches. Based on preliminary data, herring landings from the west coast of Newfoundland (4R) were 19,932 t in 2016 and 15,194 t in 2017 against a 20,000 t total allowable catch (TAC). In 2017, large and small seiners and fixed gear vessels did not catch their quotas.

- It is pointed out that the fishery is conducted in all unit areas, that is, 4Ra, 4Rb, 4Rc and 4Rd, but, since 2007, has been concentrated in 4Rb to the detriment of 4Rc and 4Rd.
- Some industry representatives state that the last fishing season was more difficult because bad weather conditions made fishing trips more perilous.

BIOLOGICAL DATA

Annual total length frequencies and age frequencies are presented for both stocks. Since 2014, herring catches have been dominated by fall spawners aged 11 and over. It is noted that the

2008 cohort contributed to the fishery, but not as significantly as the 2000 cohort. Spring spawner catches are up slightly in 2017 and consist mainly of individuals from the 2012 and 2013 cohorts.

The length-weight relationship is presented. The assessment team state that they applied a correction factor to 2004 to 2015 data, which are based on frozen fish, to obtain the length-weight data for fresh fish. This method was applied to fall and spring stocks, and the data were grouped. After the conversion is applied, fish length and weight rise, at an average increase of 3% for weight and 2% for total length.

The next presentation shows, for all fishing gear, the chart of annual fork lengths at which 50% of individuals reach maturity (L_{50}).

- Several participants ask about the calculation method that was used. The chair suggests and participants agree to form a subcommittee in the coming days (before the scheduled May 9 meeting of the advisory committee) to discuss the results and a potential review of the calculation method used.
- It is proposed to calculate the L_{50} by cohort and compare the results with the first L_{50} calculation, presented by year.
- The participants agree not to make a decision at the end of the meeting as to the scientific advice on the L_{50}, since the subcommittee will do it. A highlight summarizing the changes will be drafted and submitted to Fisheries Management, industry and scientists before the next advisory committee meeting.

MULTIDISCIPLINARY SURVEYS

Based on the Teleost multidisciplinary surveys of 2015, 2016 and 2017, the biologist provides a brief presentation of the distribution of catch rates and probabilities areas associated with the presence of herring. He also presents the dispersion index for 1990 to 2017. In the past five years, the index has been higher than the series average, though decreasing slightly since 2015. Lastly, the chart showing the herring abundance distribution for the July sentinel fishery surveys from 2015 to 2017 is presented.

2017 ACOUSTIC SURVEY

An acoustic survey was conducted from October 20 to November 3, 2017. Even though the weather conditions were unfavourable, coverage was higher than for 2015.

Several corrections were made to the calculation of the biomass index for the years 2009 to 2015 compared to the 2015 Science Advisory Report. These modifications concern the length-weight relationships, the number of lines produced, and the area of the sampled strata, as well as the gain adjustment during the calibration of the acoustic system. Following these corrections, for spring and fall spawners, a positive effect on the biomass index was observed in 2010 and 2013, and a negative effect in 2009, 2011 and 2015.

The 2017 results for herring confirm recent years' very low spring spawning biomass, despite a noticeable slight increase compared with previous results. For the fall stock, results show a nearly 20,000-tonne decline in biomass, which follows the trend started in 2015.

Corrections were made to the estimates of the dead zone which allows the fish included in the acoustic cone to be taken into account despite the strong signal from the sea bottom. This correction increased the biomass index of both stocks for 2010 and 2013. However, the index values remained similar for the other years.

The chart comparing the daily landings with the acoustic surveys' dates shows that, for 2017, there is a lag between the period when the landings were greatest and the time of year when the acoustic survey was performed. The acoustic survey period was before 50% of cumulative landings were reached, similarly to past years.

ENVIRONMENTAL IMPACT ON STOCK INDICATORS

Following the recommendations of the 2015 Science Advisory Report, the role of the environment in recruitment variations for the spring and fall spawning stocks was studied. To achieve this, principal component analyses (PCA) and general additive models (GAM) were used with the data from the 2015 stock assessments (index of spawning biomass and recruitment) and overall environmental indices.

For the spring spawning stock, three different environmental indices explaining 76% of the recruitment variability showed that it is promoted by:

- The presence of a zooplankton community typical of cold water
- An earlier phenology
- A temperature that is neither too cold nor too hot

For the fall spawning stock, three different environmental indices explaining 75% of the recruitment variability showed that it is promoted by:

- The presence of a zooplankton community typical of warm water
- An earlier phenology (except in cases of extreme values)
- A slightly warmer temperature (except in cases of extreme values)

These results provide a partial understanding of the influence of the environment on herring recruitment. On the other hand, they provide a limited contribution to Fisheries Management, since the overall environmental indices used are components that cannot be predicted. To remedy this situation, individual environmental variables for 2001 to 2016 from the Atlantic Zone Monitoring Program (AZMP) were considered. In that short period, it was possible to explain 89% and 75% of the recruitment variability for the spring and fall spawning stocks, respectively.

- The recruitment of the spring spawning stock is dependent on phytoplankton bloom and the resulting zooplankton.
- The recruitment of the fall spawning stock is directly dependent on the abundance of the different species of copepods.

The environment also explains part of the variability in physical condition and the reproduction spike. This last relationship (environment–reproduction spike) was established only for the fall spawning stock because available data were too sparse for the spring spawning stock.

ANALYTICAL MODEL

The same methodology as that of 2015 was used for the sequential population analysis (SPA). These inputs were used: catch at age, weight at age, maturity at age, index of acoustic estimates converted into numbers of fish.

- Just like the acoustic index, the SPA suggests that the herring spring spawning biomass has been very low in recent years. It is below the limit reference point set at 37,384 t. As for the herring fall spawning biomass, it has been declining for many years; although it is still in the healthy zone, it is approaching the upper reference point set at 61,074 t in 2010.

- Sequential Population Analysis (PSA) for spring and fall stocks contains uncertainties on the absolute level of spawning stock biomass. As a result, the participants agree to revise the model used and the reference points through a framework assessment review before the next peer review of these stocks in 2020.

CONCLUSIONS

IDENTIFICATION OF FUTURE RESEARCH WORK

The purpose of the work deemed a priority by the meeting is to:

- Improve sampling during the acoustic survey.
- Develop a more flexible statistical catch-at-age model. – in progress
- Include the productivity regime (environment) in the model and the reference points. – in progress
- Examine the effect of environmental changes on herring spring and fall spawners. – in progress
- Review the method of classifying spring/fall spawners.
- Review the age at which fish are grouped.

Participants propose additional research:

- Acquire new knowledge on the distribution of spring spawners.
- Explore the possibility of integrated modelling by including various spacio-temporal scales in the statistical catch-at-age model.
- Examine the possibility of analyzing historical tagging data.
- Review the reference points in the coming years.

INTERIM YEARS

The participants intend to provide an advice for the next two fishing seasons (2018 and 2019). No indices will be reviewed in the meantime and no new surveys are scheduled in 4R before fall 2019.

SCIENTIFIC ADVICE HIGHLIGHTS

The highlights are presented and the participants comment on them. The participants change some of the bullets by removing details they deem unnecessary and adding details they deem important. The participants mainly discuss the SPA bullets given their uncertainty and doubts about the conclusions that may be drawn from this analysis.

These are the meeting's main conclusions:

- Since old fish from the fall spawning stock that supported the fishery in recent years have declined and recruitment is apparently very weak, maintaining the current level of catches could bring the stock below the upper reference point in the short term.
- Given that the spring-spawning stock is still in the critical zone, it would be advisable to maintain a low level of fishing mortality.

APPENDIX 1- TERMS OF REFERENCE

Assessment of the West Coast of Newfoundland (4R) herring stocks in 2018

Regional Peer Review - Quebec Region

May 2, 2018
Mont-Joli, QC

Chairperson: Mathieu Desgagnés

Context

The west coast of Newfoundland (NAFO Division 4R) herring (*Clupea harengus*) fishery is managed by a Total Allowable Catch (TAC) associated with both spawning stocks. The current TAC of 20,000 t was set during the last analytical assessments. The TAC split between the various fleets is as follows: 55% for large seiners (> 65 '), 22% for small seiners (<65') and 23% for fixed gear.

A first series of acoustic surveys was conducted between 1991 and 2002 with the objective of evaluating the abundance of the two spawning stocks. A second series of surveys was initiated in the fall of 2009.

The last assessment of the two herring spawning stocks in 4R dates back to 2016. The Resource Management and Aboriginal Affairs Branch has requested a scientific advice on these stocks for the 2018 and 2019 fishing seasons. The objective of the review is to determine whether changes that have occurred in the stock status necessitate adjustments to management plans based on the conservation approach used.

The Resource Management and Aboriginal Affairs Branch also requested scientific advice to determine if the current minimum size limit of 26.5 cm at the fork corresponds to the 50% maturity size for herring on the west coast of Newfoundland.

Objectifs

Provide a scientific advice of the spring and fall spawning herring stocks in NAFO Division 4R (Newfoundland's West coast) for the 2018 and 2019 fishing seasons. This advice shall include:

- An evaluation of the status of the herring stocks, based on:
  - commercial fishery statistics following the 2016 and 2017 seasons (overall distribution of landings, breakdown by unit area, month and fishing gear, etc.);
  - an update of the main biological indicators (age structure, maturity, condition, etc.);
  - an estimate of mature median fork length (L_{50}) for Atlantic herring on the west coast of Newfoundland;
  - sentinel catches and index of dispersion (not abundance) calculated from the Teleost catches;
  - results of the 2017 fall acoustic survey.
- Presentation of abundance estimates from an analytical assessment in relation to reference points already available for these stocks.
- Ecosystem and environmental considerations.
  - Presentation of exploratory work on the use of environmental indices to predict the productivity of fall and spring spawning stocks for more proactive and efficient management.

- The identification and prioritization of research projects to be considered for the future.
- The determination of the process to provide advice during the interim years, including a description of conditions that may warrant a full stock assessment earlier than originally planned;
- Perspectives and/or recommendations for 2018 and 2019 based on available data.

- **Expected Publications**

- Science Advisory Report
- Proceedings
- Research Document

Participation

- Fisheries and Oceans Canada (DFO) Science and Fisheries Management
- Newfoundland and Labrador provincial government representatives
- Fishing industry
- Academia

APPENDIX 2- LIST OF PARTICIPANTS

Name	Affiliation
Anderson, Samuel	Barry Group
Barry, Bill	Barry Group
Belley, Rénald	DFO Science
Benoît, Hugues	DFO Science
Bernier, Denis	DFO Science
Boudreau, Mélanie	DFO Science
Bourdages, Hugo	DFO Science
Brassard, Claude	DFO Science
Brosset, Pablo	DFO Science
Brulotte, Sylvie	DFO Science
Castonguay, Martin	DFO Science
Chamberland, Jean-Martin	DFO Science
Christopherson, Virginie	DFO Science
Cyr, Charley	DFO Science
Dunne, Erin	DFO Fisheries management, NL region
Ellefsen, Hans-Frédéric	DFO Science
Émond, Kim	DFO Science
Gaudet, Mario	DFO Fisheries management, Gulf region
Gauthier, Johanne	DFO Science
Gilbert, Michel	DFO Science
Hurtubise, Sylvain	DFO Science
Juillet, Cédric	DFO Science
Lambert, Jean	DFO Science
Nilo, Pedro	DFO Science
Otis, Nancy	DFO Science
Ouellette-Plante, Jordan	DFO Science
Paquet, Frédéric	DFO Science
Plourde, Stéphane	DFO Science
Poirier, Mélanie	DFO Science
Rivierre, Antoine	DFO Fisheries management, Quebec region
Robert, Dominique	UQAR-ISMER
Sainte-Marie, Bernard	DFO Science
Sullivan, Karl	Barry Group
Van Beveren, Elisabeth	DFO Science
Vanier, Caroline	DFO Science